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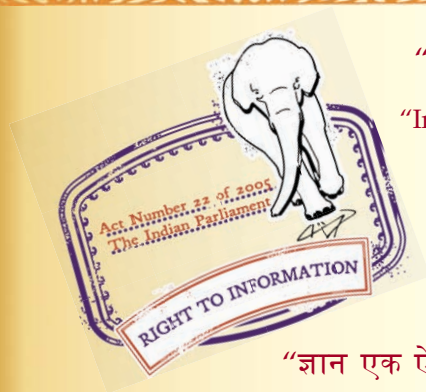
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IS 4616 (1968): Specification for sheepsfoot roller [MED
18: Construction Plant and Machinery]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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Indian Standard
SPECIFICATION FOR
SHEEPSFOOT ROLLER
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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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SPECIFICATION FOR SHEEPSFOOT ROLLER

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Indian Standard

SPECIFICATION FOR SHEEPSFOOT ROLLER

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 23 May 1968, after the draft finalized by the Construction Plant and Machinery Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Sheepsfoot rollers are intended for use in compaction of earth embankments, localized breakups of existing earth or gravel roads, and subgrade soil to increase the bearing capacity. Subject to the limitations of soil characteristics, this type of roller permits positive solid compaction with a minimum number of passes over surface areas, such as built up solid fills for highways, air-ports, dams and bridges approaches. One, two or sometimes three drum models with different type of tamping foot are obtainable, and their selection is governed by the type of job and the characteristics of soil to be compacted. This standard is intended to deal with the essential features of sheepsfoot roller to serve as guidance to both manufacturers and purchasers.

0.3 This standard contains clauses 3.2.1, 4.1 and 4.1.1 which calls for agreement between the purchaser and the supplier.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard lays down the requirements for materials, sizes, design, construction and performance of sheepsfoot roller.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definition shall apply.

2.1 Sheepsfoot Roller — Roller consisting of hollow cylindrical steel drum or drums on which projecting feet are mounted. These feet penetrate into the fill as the roller moves forward and cause compaction.

*Rules for rounding-off numerical values (revised).

3. SIZE DESIGNATION AND CLASSIFICATION

3.1 The size of the roller shall be indicated by number and external diameter in millimetres (excluding feet) of the drum it carries. The type of the roller shall be indicated by the shape of its tamping feet.

Examples:

Single Drum, 1 000, sheepsfoot
Double Drum, 1 000, sheepsfoot
Single Drum, 1 060, club foot
Double Drum, 1 000, cone foot
Single Drum, 1 000, pyramid foot
Double Drum, 1 060, cylinder foot

3.2 The standard sizes shall be as given below:

Single drum, mm	1 000; 1 060
Two drums in line, mm	1 000; 1 060; 1520

3.2.1 Sizes other than those specified above may be supplied by mutual agreement between the purchaser and the supplier.

4. MACHINE CHARACTERISTICS

4.1 Unless otherwise agreed to between the purchaser and the supplier, the roller shall have the machine characteristics specified in Table 1.

4.1.1 The shape of the tamping feet shall conform to any one of the types indicated in Fig. 1, depending upon the requirements of the job and the agreement between the purchaser and the supplier.

4.2 For sizes other than those specified in 3.2, the machine characteristics may be varied to suit the job requirements by agreement between the purchaser and the supplier, but the total tamping area of the tamping feet should be generally greater than 6 percent of the drum surface area.

5. MATERIALS

5.1 Materials used in the construction of sheepsfoot rollers shall comply with the requirements of the relevant Indian Standards.

5.1.1 *Steel Sections, Bars and Plates* — Steel sections, bars and plates shall conform to IS : 226-1962*.

5.1.2 *Mild Steel Sheets* — Mild steel sheets shall conform to IS : 1079-1963†.

5.1.3 *Rivet Bars* — Rivet bars shall conform to IS : 1148-1964‡.

*Specification for structural steel (standard quality) (*third revision*). (Since revised).

†Specification for hot rolled carbon steel sheet and strip (*revised*). (Third revision in 1973).

‡Specification for rivet bars for structural purposes (*revised*).

TABLE 1 MACHINE CHARACTERISTICS OF SHEEPSFOOT ROLLER

(Clause 4.1)

Sl. No.	MACHINE CHARACTERISTICS	SINGLE DRUM ROLLER	DOUBLE DRUM ROLLER
i)	Overall length of roller including draw bar, m	3.2 <i>Min</i> 4 <i>Max</i>	3.6 <i>Min</i> 4.5 <i>Max</i>
ii)	Overall width of roller, m	1.5 <i>Min</i> 1.55 <i>Max</i>	3.0 <i>Min</i> 3.5 <i>Max</i>
iii)	Length of each drum, mm	1 220 \pm 20	1 220 \pm 20 or 1 800 \pm 10*
iv)	Diameter (less tamping feet) of each drum, mm	1 000 \pm 20 or 1 060 \pm 20	1 000 \pm 20 or 1 060 \pm 20 or 1 520 \pm 20*
v)	Number of tamping feet:	64 <i>Min</i> 112 <i>Max</i>	64 <i>Min</i> 112 <i>Max</i> (120 <i>Max</i> with size 1 800 \pm 10 mm only)
a)	Length of tamping feet, mm	178 <i>Min</i> 203 <i>Max</i>	178 <i>Min</i> 203 <i>Max</i>
b)	Tamping area of tamping feet, cm ²	25 <i>Min</i> 77.5 <i>Max</i>	25 <i>Min</i> 77.5 <i>Max</i>
vi)	Total weight of the roller, kg:		
a)	Drum empty	1 400 <i>Min</i> 1 650 <i>Max</i>	2 600 <i>Min</i> 3 100 <i>Max</i>
b)	Ballasted with water	2 200 <i>Min</i> 2 400 <i>Max</i>	4 200 <i>Min</i> 4 700 <i>Max</i>
c)	Ballasted with sand and water	3 000 <i>Min</i> 3 200 <i>Max</i>	5 000 <i>Min</i> 6 500 <i>Max</i>
vii)	Ground pressure under each tamping foot, kg/cm ² :		
a)	Drum empty	11.5 <i>Min</i>	10.5 <i>Min</i>
b)	Ballasted with water	18.5 <i>Min</i>	17.5 <i>Min</i>
c)	Ballasted with water and sand	21.5 <i>Min</i>	20.5 <i>Min</i>

*Diameter 1 520 \pm 20 mm to match only with length 1 800 \pm 10 mm.

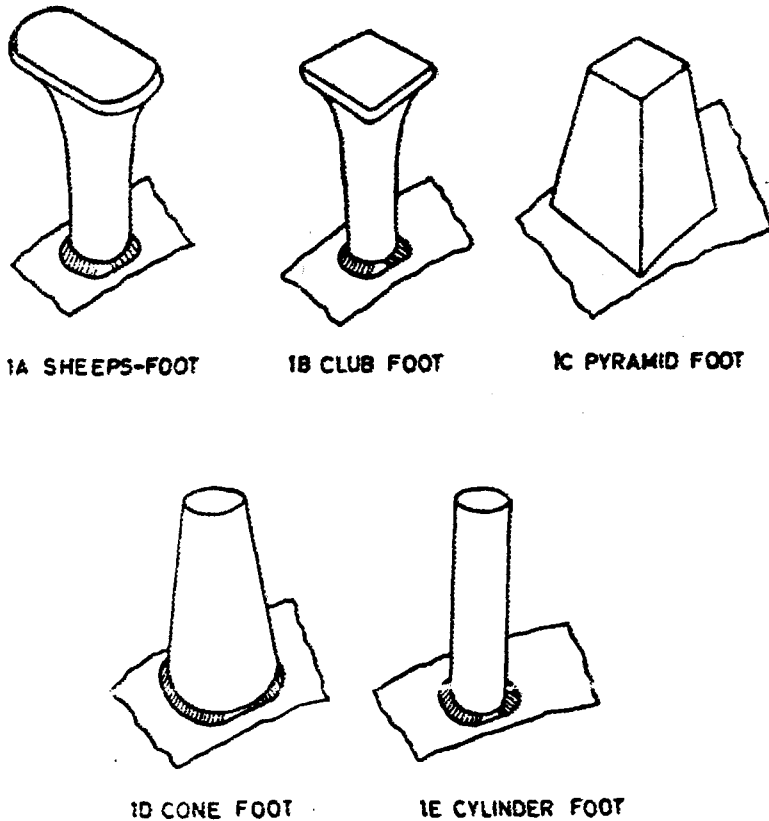


FIG. 1 ALTERNATIVE TYPES OF TAMPING FEET
FOR SHEEPSFOOT ROLLER

6. CONSTRUCTION

6.1 General — The roller shall be mounted in a frame that will permit independent oscillation of each drum. The roller shall withstand the strains imposed by operation over rough and rocky ground at a speed of 8 km/h.

6.2 Frame — Drum frames shall be made of structural steel or formed steel plate and shall be rigidly braced. The drum frames shall be connected so that each drum oscillates independently of the other drums through an angle of at least 30 degrees, and the horizontal plane through the axis of oscillation shall bisect this angle. A positive means shall be provided to limit oscillation of drums and it shall prevent drums from interlocking.

6.3 Drawbar — The drawbar shall be removable and replaceable without cutting or welding. The drawbar shall be of such design and construction as to permit either pulling or pushing of the roller. The drawbar shall be equipped with an adjustable, universal-type, joint coupler which will attach to a standard drawbar for industrial (track-type) tractors except the towing pin hole shall accommodate a 50 mm pin.

6.4 Rear Clevis — A clevis shall be attached to the rear main-frame member and shall contain a hole to accommodate a 50 mm pin to permit tandem operation of rollers.

6.5 Drums — The shell and heads of each drum shall be constructed of steel plates not less than 12 mm thick. The joints shall be welded and watertight.

6.5.1 Ballasting Arrangement — A ballast hole with an area of not less than 325 cm² and a drainage hole for accommodating a 50 mm pipe plug shall be provided for ballasting the drums with water or sand. The holes shall be located on the outside end near the perimeter of the drum and shall be equipped with removable watertight covers.

6.5.1.1 Any other suitable ballasting arrangements, such as, ballast boxes mounted on the frame in front of and/or behind the drum may be provided.

6.6 Tamping Feet — The tamping feet shall be of any of the type indicated in Fig. 1. The tamping feet shall be arranged in equally spaced rows circumferentially around the drum with those in successive rows staggered. The tamping feet shall be arranged to provide not less than one tamping foot per 900 cm² of drum cylinder circumferential surface area.

6.6.1 The tamping feet shall have tapered shanks and shall have replaceable tamping tips. The tamping feet shanks shall be cast or forged from steel and shall be welded to the drum. The tamping tips shall be steel heat treated to a Brinell hardness of not less than 260 and replaceable without burning or welding.

6.7 Axles and Bearings — Each drum shall be equipped with an independent axle extending entirely through the drum. The axle or drum shall be mounted on anti-friction bearings with dust tight, and watertight seals. Bearings shall be adjustable without removal of drum from axle or axle from frame.

6.8 Cleaners — Adjustable cleaners shall be provided and shall prevent accumulation of material on the drums when the drums are operated in either the forward or reverse direction. Cleaners shall be replaceable.

6.9 Lifting Attachments — The roller shall be provided with lifting attachments. The attachments shall enable the roller to be lifted in its normal travelling or operating position. The attachments shall be located

so that clearance is maintained between the slings and all exterior parts of the roller. Spreader bars may be provided. Each attachment shall withstand not less than $2\frac{1}{2}$ times the normal load imposed on the attachment. Attachments for multiple slings shall be located so that the slings will converge not more than 5.5 m above the lowest extremity of the load when such limitation is possible. Attachments shall be positioned so that the lifting strain will be in line with the longitudinal axis of the eye of the attachment. The inside diameter of the eye shall be not less than 75 mm. Members to which attachments are fastened, and the fastenings shall withstand stresses in the amount and direction of pull specified for the attachment. Where required, structural members shall be reinforced to meet the lifting requirements specified herein. Lifting attachments may also be used as tie-down attachments when such attachments meet the requirements specified in 6.10.

6.10 Tie-Down Attachments — The roller shall be provided with integral attachments to permit tie-down to the floor or deck of the transportation medium. The tie-down attachment shall withstand static loads of 8G, 8G, 2.25 G and 1.5 G forward, rearward, upward and sideward respectively, where G is the cargo weight of the roller. Tie-down attachments may also be used as lifting attachments when such attachments meet the requirements specified in 6.9.

6.11 Workmanship — All parts, components, and assemblies of the roller including castings, forgings, moulded parts, stampings, bearings, seals, machined surfaces, and welded parts shall be clean and free from sand, dirt, fins, pits, sprues, scale, flux, and other harmful extraneous material. External surfaces shall be smooth, and all exposed edges shall be rounded or bevelled.

6.11.1 Steel Fabrication — Steel used in the fabrication of the roller shall be free from kinks and sharp bends. The straightening of material shall be done by methods that will not cause injury to the metal. Shearing and chipping shall be done neatly and accurately. Corners shall be square and true, and all burrs shall be removed. Flame cutting may be employed instead of shearing or sawing. Burned surfaces of flame-cut material shall be ground smooth. Precautions shall be taken to avoid overheating, and heated metals shall be allowed to cool slowly. All bends of a major character shall be made with metal dies or fixtures to insure uniformity of size and shape.

6.11.2 Bolted Connections — Bolt holes shall be accurately punched or drilled and shall have the burrs removed. Washers or lock-washers shall be provided in accordance with accepted practice, and all bolts, nuts and screws shall be tight. Devices securing bolts or cap screws shall be of sufficient strength to withstand the tensile strength of the bolt.

6.11.3 Riveted Connections — Rivet holes shall be accurately punched or drilled and shall have the burrs removed. Rivets shall completely fill the

holes. Rivet heads shall be full, neatly made, concentric with the rivet holes, and in full contact with the surface of the member.

6.11.4 Welding — The surface of parts to be welded shall be free from rust, scale, paint, grease, and other foreign matter. Welds shall transmit stress without permanent deformation or failure when the parts connected by the welds are subjected to proof and service loadings.

6.12 Finishing — All parts of the roller normally painted shall be cleaned, treated and painted in accordance with relevant Indian Standards.

7. LUBRICATION

7.1 All surfaces requiring lubrication shall be provided with suitable means for lubricating.

8. MAINTENANCE TOOLS AND ACCESSORIES

8.1 Tools for normal maintenance, adjustments and lubrication together with instructions and inventory of tools shall be provided with the machine.

9. MARKING

9.1 The following information shall be permanently and conspicuously marked on the roller:

- a) Manufacturer's name or trade-mark,
- b) Manufacturer's reference number of the roller, and
- c) Year of manufacture.

9.1.1 The gross weight of each roller shall be conspicuously and indelibly marked on each side of the frame.

9.1.2 A transportation data plate (*see* 6.9 and 6.10) shall be permanently affixed to the roller frame in a conspicuous place and shall indicate location and capacity of lifting and tie-down attachments.

9.1.3 The roller may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

10. PERFORMANCE

10.1 The roller shall conform to the performance tests specified in 10.2.

10.2 Tests

10.2.1 Test Conditions — For the purpose of these tests, a test roller is defined as the roller being tested when more than one roller is used to accomplish the test. The test roller shall be lubricated in the usual manner prescribed by the manufacturer.

10.2.2 Operational Test — The test roller shall be filled with water and hitched to a tractor. A second roller filled with water and of the same size as the test roller shall be hooked in tandem with the test roller. The roller assembly shall be towed over rock and earth fill for a period of 8 hours. A speed of approximately 8 km/h shall be maintained and all turns shall be made in the shortest possible turning radius. The roller assembly shall then be towed for 4 hours over loose fill with a moisture and fine material content which will cause fill material to stick to the roller drums. Ten percent of the replaceable tamping tips shall be removed upon completion of 8 hours of towing, and replaced with new tamping tips. The test roller shall be observed during this test. Any evidence of water leakage, inability of drums to oscillate as specified, inability of cleaners to prevent buildup of material on drums, inability to remove and replace tamping tips as specified, or any permanent deformation or breakage of components or parts shall constitute failure of this test.

10.2.3 Ground Pressure of Tamping-Foot Face — The roller shall be weighed with drums empty, with drums full of water, and with drums and/or ballasting box full of sand and water. The ground pressure of the tamping-foot face shall be determined for the roller with empty drums, for the roller with drums filled with water, and for the roller with drums and/or ballasting box filled with sand and water by the following formula:

$$P = \frac{W}{MNA}$$

where

- P = ground pressure of tamping-foot face in kg/cm²,
- W = weight of roller in kg,
- M = number of tamping-feet per drum on the ground,
- N = number of drums, and
- A = area of tamping-foot face in cm².

Computed ground pressure of tamping-foot face not complying with 4 shall constitute failure of this test.

10.2.4 Tie-down and Lifting Attachments — The static load as specified in 6.9 for lifting attachments and in 6.10 for tie-down attachments shall be applied to each attachment when mounted on its structural member. Weld failure or permanent deformation of the attachment, the fastening, or the structural member shall constitute failure of this test.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Conversion
Force	newton	N	1 N = 1 kg.1 m/s ²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s (s ⁻¹)
Electric conductance	siemens	S	1 S = 1 A/V
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²

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